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VARIANCE IN HERBARIUM SPECIMEN IDENTIFICATION AND OTHER CONSIDERATIONS BASED UPON THE PREPARATION OF A LOCAL FLORA

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"A universal, to Aristotle, is any common noun, any name capable of universal application to the members of a class: so *animal*, *man*, *book*, *tree*, are universals. But these universals are subjective notions, not tangibly objective realities; they are *nomina* (names), not *res* (things); all that exists outside us is a world of individual and specific objects, not of generic and universal things; men exist, and trees, and animals; but man-in-general, or the universal man, does not exist, except in thought; he is a handy mental abstraction, not an external presence or re-ality" (Durant, 1953).

Some 2200 years after Aristotle, Gleason (1933) reflected: "It is now generally recognized that a species is an abstract mental concept. . . . To this concept is given a binominal name. . . . The assignment of the individual to a certain concept constitutes identification. . . . The name which appears on a herbarium sheet represents the opinion of some person." Gleason also has pointed out that specific concepts vary through accumulation of study material and through changed mental attitudes and emphasizes that, ". . . the probability that a specimen is correctly identified, that is, that it correctly illustrates a certain specific concept, depends largely on the person making the identification and on the date when it was made."

The foregoing comments are intended to serve as an initial warning that the data to follow, though objective in appear-

ance, are at least partially quite subjective. Yet, since few would disagree that the boundaries of most present-day-recognized species are ". . . real, objective phenomena" (Stebbins, 1950), the data presented here may be of some interest.

In 1952 work was begun which culminated in a survey of the vascular flora of 16 counties of southeastern Iowa (Davidson, 1957). The field work done in this connection encompassed at least parts of four growing seasons during which some 15,000 miles were traveled, innumerable notes taken, and some 4,400 collections, totaling an estimated 9,000 individual specimens, made. In identifying these specimens[1] every effort was made to check as carefully as possible identifications of all specimens collected previously from southeast Iowa and deposited in the Herbarium of the State University of Iowa (IA). Eventually similar consideration was given to all southeast Iowa species included neither in the new collections not at IA but represented in the herbaria of Iowa State University, Parsons College, and Iowa Wesleyan College. A few critical specimens were examined at the Barnes' Herbarium of the Davenport Public Museum. For the most part, however, the data cited bear upon representatives of the flora of southeast Iowa on deposit at IA.

This herbarium houses some 125,000 vascular plants. Curated in the past by B. S. Shimek, L. M. Cavanaugh, W. A. Anderson, and currently by R. F. Thorne, the permanent collection at the time of the study was in good condition; nevertheless, special care was taken during the investigation to discard or ignore fragmentary material which *per se* would be subject to non-reliable identification. Student collections, other than those associated with formal graduate-level research, have not been incorporated into the permanent collection and almost without exception specimens and their identifications reflect the field work and opinions of experienced taxonomists.

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[1]Recent regional manuals (Fernald, 1950; Gleason, 1952), monographs and revisions, and other appropriate literature were consulted in identifying materials, in the application of names, and in the compilation of synonymy. In a few cases deviations from the literature were necessary to express other taxonomic opinions.

Reporting the data presented here is possible due to an earlier belief that differences in opinion regarding the correct identity of herbarium specimens might relate to certain evolutionary considerations. When idealized this reasoning would run something like this:

1. In a given area, species which are clearly defined and not associated with close relatives nor subject to introgression, etc., are subject to greater unanimity of opinion regarding their identity than are species for which there are close relatives or between which introgression, hybridization, intergradation, etc., occur.
2. "Misidentification"[2] thus is more closely associated with "critical" taxonomic groups than with "non-critical" groups.
3. Critical groups are more often closely associated with recent and current evolutionary flux than with old evolutionary stability.
4. Misidentification is thus related to evolution and perhaps to evolutionary stage.

The idealized "logical" conclusion follows that, *e. g.*, if we detected 20% misidentifications within the family Compositae amongst 50 genera including 200 species while we found only 5% misidentifications within the family Leguminosae amongst 50 genera and 200 species, we might assume that the Compositae is (at least as represented in a given area) in a stage of greater evolutionary flux than is the Leguminosae.

It seems apparent, however, that such a scheme would be feasible only if numerous qualifications were made and if large floristic segments were studied within the framework of a taxonomy much more refined than that with which we now work. In any event, rather vague thinking along the preceding lines caused accurate records to be kept on each herbarium specimen considered to be misidentified. These records may be summarized as follows:

A total of 1252 species, comprising 507 genera and 124 families, currently are known to occur in southeast Iowa.

Of these, 1148 were already represented in the herbaria consulted by the time the senior author's field work was initiated. Thus this more recent field work, resulting in the

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[2]"Misidentification" is used for simplicity throughout this paper to mean: "difference in opinion regarding the identity of. . ." Thus a misidentification was scored each time one of us (R.A.D.) disagreed with the label identification, or the latest annotation, of a herbarium specimen.

collection of 4435 numbers, increased the number of species comprising the flora of southeast Iowa previously uncollected in the area by 8.3%. One unrecorded species was collected for each 42.3 collection numbers. Said in another way, 2.3% of the new collections represented species previously unknown to the area.

Of the 3997 herbarium specimens examined, 184 (or 4.6%) were considered misidentified (this number does not include approximately 35 specimens considered to be putative hybrids). Upon correction these 184 specimens were included in the 507 specimens which represented the 139 species for which misidentified specimens were found. By relating the latter figure to the 1148 species represented in the herbaria we can calculate that 12.1% of all species was falsely represented by at least one herbarium specimen. This figure is of some importance inasmuch as the speed and clarity with which one arrives to a given species concept depends in large part upon the examination of a series of correctly identified specimens.

Before re-identification, the 184 misidentified specimens allegedly represented 60 species (synonymy taken into account here as elsewhere) not currently known to be present in southeast Iowa. Thus, for the segment studied, the herbarium was 4.8% richer in species than it should have been. It is suspected that this trend may reflect the taxonomists' "unconscious" desire to find rarities.

On the other hand, the 184 misidentified specimens when re-identified accounted for 21 species which are currently represented by one or more formerly misidentified specimens only. In other words, 21 species now considered validly present in the flora of southeast Iowa were neither represented in the herbarium before the present study nor collected during it. Thus some 1.7% of the total flora was hidden in the herbarium through misidentification.

Table 1 lists all families represented by 20 or more herbarium specimens, giving the included number of genera, species, specimens, misidentified specimens, and the percentage of misidentification. Few, if any, generalizations on the

TABLE 1. DATA ON PLANT FAMILIES REPRESENTED BY TWENTY OR MORE HERBARIUM SPECIMENS

Family	Number Genera	Number Species	Total Specimens	"Misidentified"	Percent "Misidentified"
Equisetaceae	1	4	24	0	0
Aspidiaceae	8	15	68	0	0
Potamogetonaceae	1	11	31	2	6.4
Gramineae	51	118	441	36	8.1
Cyperaceae	9	72	178	10	5.6
Araceae	3	4	22	0	0
Commelinaceae	2	4	23	0	0
Juncaceae	2	11	23	6	26.0
Liliaceae	10	22	62	0	0
Salicaceae	2	16	64	1	1.5
Betulaceae	4	4	36	1	2.7
Fagaceae	1	9	73	0	0
Polygonaceae	4	27	84	4	4.7
Chenopodiaceae	3	12	24	4	16.6
Amaranthaceae	3	10	36	1	2.7
Caryophyllaceae	8	16	45	0	0
Ranunculaceae	12	28	133	0	0
Papaveraceae	4	7	23	1	4.3
Cruciferae	16	32	62	8	12.9
Saxifragaceae	6	9	29	0	0
Rosaceae	4	41	143	15	10.4
Leguminosae	28	55	215	3	1.3
Rutaceae	2	2	22	0	0
Polygalaceae	1	5	24	0	0
Euphorbiaceae	3	19	57	0	0
Anacardiaceae	1	4	41	0	0
Vitaceae	3	6	25	1	4.0
Malvaceae	6	7	20	0	0
Guttiferae	1	9	28	3	10.7
Violaceae	1	16	58	17	29.3
Onagraceae	5	12	39	0	0
Umbelliferae	17	23	49	6	12.2
Primulaceae	3	8	29	1	3.4
Asclepiadaceae	2	12	21	0	0
Convolvulaceae	3	14	36	4	11.1
Boraginaceae	7	11	37	0	0
Verbenaceae	2	6	42	0	0
Labiatae	20	40	161	13	8.0
Solanaceae	5	12	40	2	5.0
Scrophulariaceae	19	39	162	0	0
Acanthaceae	2	3	21	0	0

Plantaginaceae	1	7	22	0	0
Rubiaceae	3	8	42	2	4.7
Caprifoliaceae	6	12	40	1	2.5
Campanulaceae	3	7	39	1	2.5
Compositae	52	153	509	32	6.2

cause of misidentification are discernable with any degree of certainty. The quality of misidentifications ranged from genera mistaken for other genera (e. g., *Anthemis* for *Matricaria*, *Crepis* for *Pyrrhopappus*, *Eragrostis* for *Leptoloma*, *Pontederia* for *Heteranthera*, *Thaspium* for *Pastinaca*, etc.) to "closely related species" being confused (e. g., *Mentha* spp., *Viola* spp., *Muhlenbergia* spp., etc.). The relative technicality of the taxonomy of a given group may or may not be important (at any rate, any attempt to isolate this as a single factor probably would be futile). The Euphorbiaceae, a rather technical group with few critical species (*Euphorbia heterophylla* L. and *E. dentata* Michx. being notable exceptions), was represented by 57 specimens all correctly identified. On the other hand approximately 12% of the 49 specimens representing the Umbelliferae, also technical but with few critical species noted, was misidentified. The Cyperaceae, at once quite technical and apparently including many taxonomic problems, was represented by 178 specimens of which only 5.6% was misidentified (the figure quite close to the 4.6% "Grand 'Misidentification' Average" for the entire herbarium segment studied). In the Gramineae, similarly technical and also with several critical species complexes, misidentifications were found in 8.1% of the 441 representative specimens. The Juncaceae, technical, but with few taxonomic problems encountered, was represented by 23 specimens of which 26% was misidentified. The taxonomy of the Chenopodiaceae and Amaranthaceae might be considered more or less equally technical, but of the two families species of the Amaranthaceae seem generally less well defined; yet of 24 chenopodiaceous specimens 16.6% was misidentified while of 36 amaranthaceous specimens only 2.7% was misidentified. Less technical, but with several outstandingly difficult genera, the Rosaceae bore a misidentification figure of 10.4%. The large misidentification

percentage for the Violaceae (29.3% of 58 specimens) probably reflects the biological complexity (introgression, etc.) of *Viola* and concomitant difficulties in its taxonomic interpretation plus intensive recent work on the group.[3] The surprising low misidentification percentages given for the Salicaceae and Fagaceae, both apparently containing biologically complex entities, are probably best accounted for by the fact that many specimens considered uninterpretable were not included in the tally as neither were specimens considered putative hybrids.

The number of families (some, e. g., the Scrophulariaceae and Ranunculaceae, represented by relatively large numbers of specimens) for which no misidentifications were detected seems surprisingly large.

It should be re-emphasized that the "facts" and "figures" presented here are, actually, only quasi-facts and -figures. Without qualifications they are not strictly appropriate for mathematical manipulations; with the qualifications that are indicated they seem even less so. These qualifications are of a compounding nature with each seriously affecting the others. In the first place, are the species under consideration actually real with objective, definable limits? Probably most are while some are not — what is the percentage of each in the total flora? How much error is the result of carelessness? For those species that are real, how adequate has been their perception, and how adequately have these perceptions been set to the language of keys, descriptions, etc? How uniformly do various taxonomists interpret this language (which as Gleason, *op. cit.*, has pointed out changes with time) and how much more, or less, accurate are recent identifications than preceding ones? These are just a few of the questions that come to mind.

Probably very little of significance can be deduced from this minor side-study. However, an attempt has been made to indicate some of the effects of recent field work on the known flora of a given sector and to quantitate differences of opinion regarding the composition of this flora. — DEPT. OF BOTANY, UNIVERSITY OF WISCONSIN, MADISON, WISCONSIN.

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[3]Specimens were examined and annotated by Dr. Norman H. Russell.

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A NEW ZEPHYRANTHES FROM SOUTHERN TEXAS

FRED B. JONES

Zephyranthes refugiensis *sp. nov.* Bulbus subglobosus 2-2.7 cm. diam.; folia linearia; ad basim 2-3 mm. lat., usque ad 25 cm. long.; pedunculus 15-23 cm. alt.; spatha 2.2-2.8 cm. long. integra, fenestrata aut bifida, dimidio inferiore tubulari; pedicellus 8-16 mm. long.; perianthus erectus, tubo 1.5-2.4 cm. long., viridi; segmenta perianthi oblanceolata ad lanceolata, flava; stylus erectus, antheras attingens; stigma album breviter trilobatum.

Bulb subglobose, 2-2.7 cm. wide x 1.7-2.3 cm. high, tunics dark brown; neck 4-5 cm. long; leaves linear, 2-3 mm. wide at base, to 25 cm. long, grayish green, channelled on upper side, convex on lower side, apex subacute to rounded; peduncle 15-23 cm. high, 3-4 mm. wide at base, 2-3 mm. wide at apex, round to slightly flattened, one-flowered; spathe membranous, 2.2-2.8 cm. long, entire, fenestrate or bifid, the lower half tubular, purplish; pedicel 8-16 mm. long; ovary 4-6 mm. long, 3-4 mm. wide; perianth erect, 3.4-4.5 cm. long, the limb funnelform; perianth tube 1.5-2.4 cm. long, 2-3 mm. wide at base, 3-4 mm. wide at apex, yellowish green; perianth segments oblanceolate to lanceolate, yellow (Wilson, 2-3), greenish at base, often flushed with red on outside; petaline segments 20-28 mm. long, 7-11 mm. wide; sepaline segments approximately as long but usually 1 mm. wider; filaments inserted at the throat of the perianth tube, suberect, somewhat flattened, light greenish yellow; sepaline filaments 7-10 mm. long, petaline filaments usually 1 mm. longer; anthers versatile, suberect, affixed much below the middle, 8-10 mm. long at anthesis, the pollen orange-yellow; style erect, greenish below, white in the upper part, reaching apexes of filaments or even of anthers; stigma shortly three-lobed, white; capsule deeply three-lobed; seeds D-shaped, 5-6 mm. long, black.